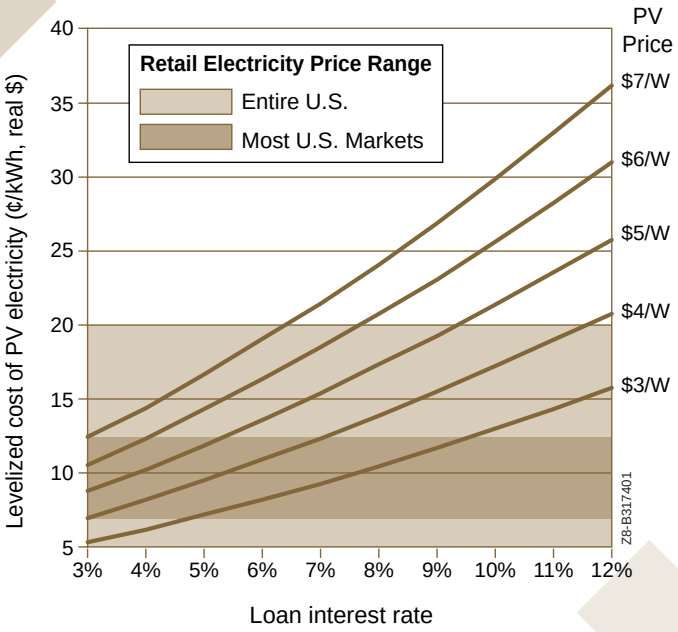
New Policies Jump-Start Solar Markets

How a new wave of policy incentives can boost economics and markets for grid-connected photovoltaics and other solar technologies

California provides an example of how to stimulate people to choose and invest in the PV energy option. The state is considering a low-cost revolving loan program, administered through a "solar bank," primarily for consumer-based PV systems. Another innovative loan program involves green mortgages, also known as energy-efficient mortgages. Consumers benefit from purchasing homes that use energy-efficient designs and renewable energy. These home buyers can qualify for preferred loan packages and larger mortgages because of their projected savings on future utility bills.



Low-interest loans, coupled with rebates to lower the price of a PV system, can help PV compete with retail rates (shaded zones).

Production Incentives—Consumers are compensated for every kilowatt-hour of electricity generated by their PV system. Such incentives are used extensively in Germany, where compensation levels of $0.70-$1.40 per kilowatt-hour have resulted in a grid-connected PV market of 2 megawatts per year. At this time, the United States only has production incentives for manufacturers, not consumers. But depending on geographic location and incentive structure, consumers would respond to incentives in the range of 25-50 cents per kilowatt-hour.

Green Pricing—Utility customers interested in seeing more renewables used to generate electricity can opt to pay a premium on top of their normal bill to help fund PV systems owned by the utilities. Other green-pricing options include customers purchasing "shares" of PV capacity or paying fixed monthly fees. Green-pricing premiums alone cannot create a significant, broad market share for PV. Multiple market-based policies are needed in even the most-promising target cities.

Making Changes for the Public Good

Various policy options can effectively stimulate residential and commercial markets for renewable-energy technologies. For grid-connected PV systems in the United States, a mix of market-based policies—including net metering, rebates, and low-interest loans—provides immediate positive cash-flow to consumers in the highest-ranked U.S. cities. Break-even PV system prices, or the price at which the net present value of cash flows goes to zero, range from $6 to $11 per watt.

The bottom line is that these policy options can help to create sustainable markets for grid-connected PV systems and meet state economic goals while doing so. By promoting these policies, legislators and regulators are speeding the commercialization of PV and other renewables, and are contributing to the public good.

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Policies Emerge through Restructuring

Market research across the nation indicates clearly that a significant number of people want clean, environmentally benign energy—and specifically, solar technologies. One avenue to motivate additional residential and commercial electricity users to consider renewable energy is through favorable energy-related policies.

Our electric utility industry is transitioning from a regulated monopoly to a more competitive business as deregulation and restructuring sweeps the nation. During this period, the public benefits of renewable energy could be lost to competition that is based solely on price. However, various analyses indicate that well-crafted policies for solar-technology deployment can boost local and regional economies while producing the positive environmental effects that consumers desire.

Forward-looking legislators, regulators, and utilities—in our country and others—are promoting policy options to improve the economics and market share of renewable energy. Services provided by the National Center for Photovoltaics, along with programs such as the President's Million Solar Roofs Initiative, will maximize the benefits from these policies.

The Policy Toolbox

Policy options generally fall into one of two overall funding mechanisms: those which create renewable energy programs and those which help consumers actively engage in renewable-technology purchases. These policy options can be tailored to work together to stimulate markets for specific technologies such as solar-thermal and solar-electric or photovoltaics (PV). The following policy tools are either implemented already or are being considered in state-led restructuring activities.

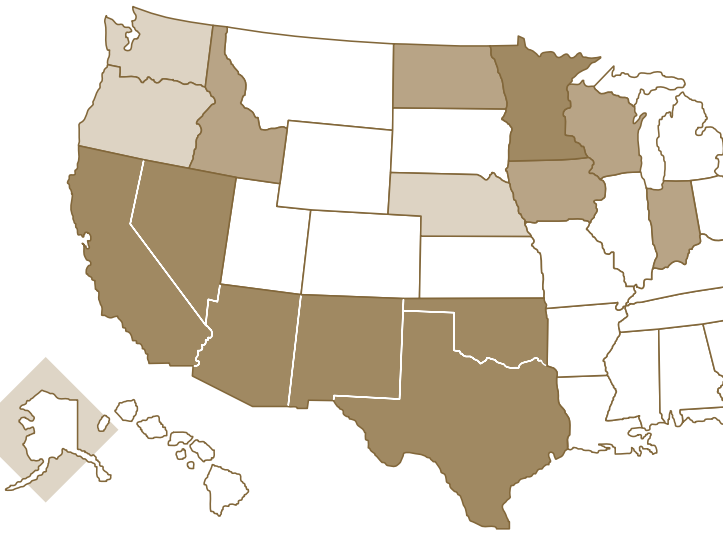
Create Renewables Programs

System Benefits Charges—With restructuring, many debts and services that were handled easily within a regulated monopoly are at risk of being "stranded" or discontinued. The system benefits charge is a mechanism for funding stranded benefits such as renewable energy deployment, energy efficiency, and low-income subsidies. Through the SBC, all electricity customers pay a small surcharge on their energy use. The charge of 0.3 cent per kilowatt-hour or less, which is only 5% of the total stranded debt, is collected into a pool to fund these benefits desired by the public. California's Assembly Bill 1890 provides for a system benefits fund through a "competitive transition charge," a portion of which will raise $54 million to buy down the cost of more than 10,000 PV systems during 1998-2001.

Renewables Portfolio Standard—Another approach that has emerged from deregulation mandates is the renewables portfolio standard, which requires that at least a percentage of competitively sold electricity must be generated from renewable resources. Regulators in Arizona have adopted a solar portfolio standard starting at 0.5% in 1999 and increasing to 1% in 2002. This standard could lead to 75-130 megawatts of new solar-electric generating capacity by 2004.

Help Engage Consumers

Net Metering—In more than 20 states, customers who own PV systems can benefit from laws and regulations that require a "net" electric meter reading. The customer is billed for the "net" electricity purchased from



Net Metering:

Available { Investor-Owned Utilities and Rural Electric Cooperatives; Investor-Owned Utilities only }

Pending/Active

Not Available

Available: AZ, CA, CT, IA, ID, IN, MA, MD, ME, MN, ND, NH, NM, NV, NY, OK, PA, RI, TX, WI

Pending/Active: NB, OR, VT, WA

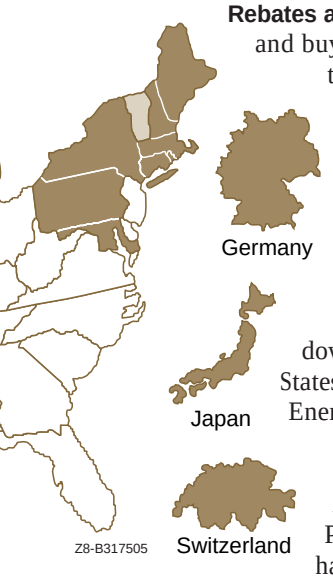
The Impact of Policies on Econ

To see how some of these policies impact the economics of grid-connected PV across the country, we compared 20 cities in the United States. These cities were selected because they are located in the top U.S. states for grid-connected PV based on today's incentives.

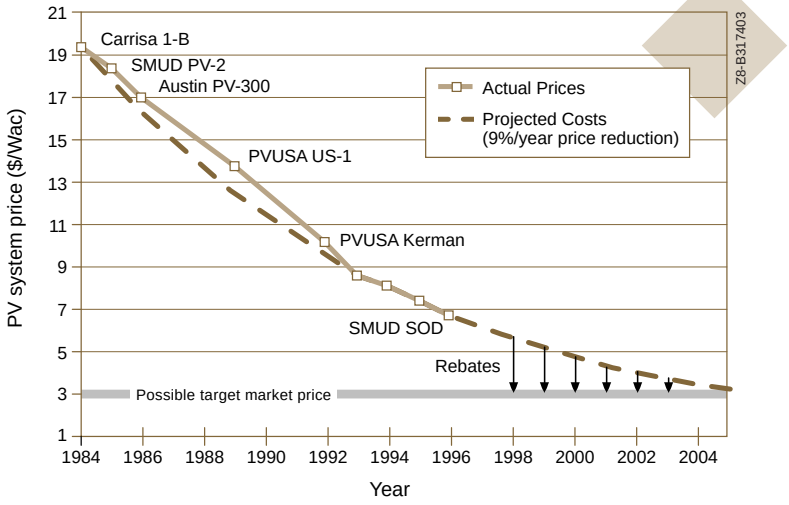
The Base-Case Scenario is for a residential, grid-connected PV system, with the cost of the PV system included in the homeowner's mortgage.

Rooftop system: . . . . . .2 kilowatts
Price: . . . . . .$12,000, or $6 per watt
Financing: . . . . . .30-year mortgage at 8% fixed interest rate
Federal tax rate: 28%
Inflation rate: . . . . . .3.5% per year
Monthly cash flow: . . . . . .PV energy savings minus after-tax loan payment

the utility over the entire billing period—that is, the difference between the electricity coming from the power grid and the electricity generated by the PV system. Hence, the monthly reading indicates *net* customer usage. Through net metering, the customer obtains the full retail electricity rate—rather than the much lower wholesale rate—for kilowatt-hours of PV-produced electricity sent back to the utility power grid. The consumer benefits of net metering are especially significant in areas such as Hawaii and New York, which have high retail rates. Utilities also benefit because the solar-generated energy often coincides with their peak demand.



Rebates and Buy-Downs—Rebates and buy-downs, typically based on the power of the system, help to defray high capital costs and are justified by creating competitive, sustainable market growth. Japan has been spurring its 70,000 Solar Roofs program through tens of millions of dollars of equipment buy-downs. And in the United States, the U.S. Department of Energy has been involved in a program known as TEAM-UP, or Technology Experience to Accelerate Markets in Utility Photovoltaics. This program has a goal of 50 megawatts and has already contracted for 8 megawatts of grid-connected PV, with supplier buy-downs and consumer rebates between $2-$4 per watt. California's AB 1890 began a consumer buy-down program in early 1998.



Rebates will accelerate a target market price such as $3 per watt.

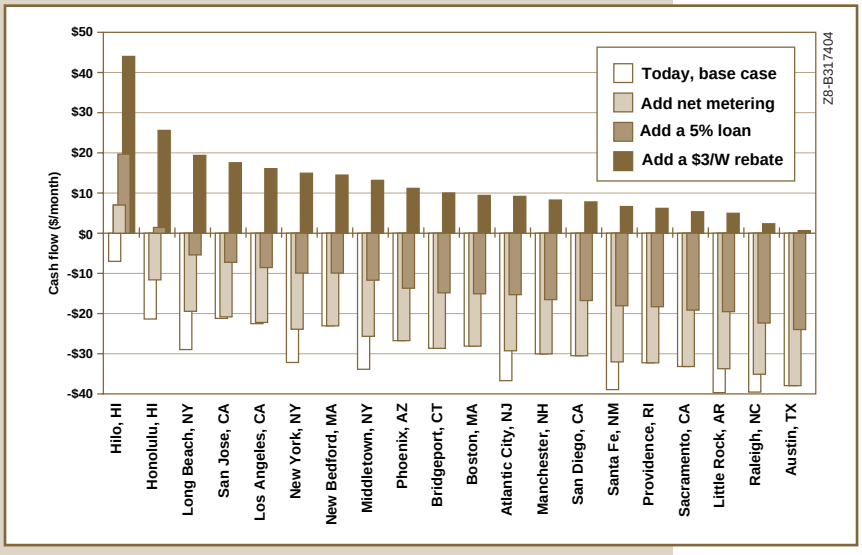
Tax Incentives—Tax incentives may include exemption of sales tax on the PV system purchase (Arizona, Florida), exemption of property tax (Connecticut, Nevada, New Hampshire), or state personal income-tax credits (Hawaii, Massachusetts, North Carolina), which provide the greatest economic benefit to consumers by lowering high capital costs. Federal tax incentives are being considered.

Low-Interest Loans—The cost of a PV system calls for attractive financing and loan terms. Photovoltaics can compete with current retail electric rates in much of the United States for $3-$4 per watt, if coupled with interest rates on loans of about 4%-6%, which are below the market average. The graph (see back page) shows the impact on electricity rate of loan-rate percentage and the price per watt of a PV system.

OMICS: LOOKING AT 20 U.S. CITIES

We then analyzed the effect of various policies on this base case. The chart (see right) shows the results on monthly cash flow of: net metering, net metering + 5% financing, and net metering + 5% financing + $3-per-watt rebate. We assumed retail electric rates and PV capacity factors at the current levels, and included net metering and state tax credits where applicable. The $3-per-watt rebate knocks down the PV system price to $3 per watt. And the low-interest financing is three percentage points below the base-case rate.

These rankings indicate that the eastern and western United States have the most-promising markets for grid-connected PV. The reasons are progressive energy-related policies and high retail rates for electricity. Cities not shown in this figure may also be promising markets if aggressive policies are implemented.



Positive cash flow is the cumulative impact of adding net metering, 5% loans, and $3/watt rebates to the base-case analyses in these 20 cities.